

TIMOTHY J. SULLIVAN, Ph.D., 4-7-09

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IN THE UNITED STATES DISTRICT COURT FOR THE  
NORTHERN DISTRICT OF OKLAHOMA

W. A. DREW EDMONDSON, in his )  
capacity as ATTORNEY GENERAL )  
OF THE STATE OF OKLAHOMA and ) 09:03:25  
OKLAHOMA SECRETARY OF THE ) 09:03:25  
ENVIRONMENT C. MILES TOLBERT,) )  
in his capacity as the )  
TRUSTEE FOR NATURAL RESOURCES) )  
FOR THE STATE OF OKLAHOMA, )  
 )  
Plaintiff, )  
 )  
vs. ) 4:05-CV-00329-TCK-SAJ  
 ) 09:03:25  
TYSON FOODS, INC., et al, ) 09:03:25  
 )  
Defendants. )

- - - - -

VOLUME I VIDEOTAPED DEPOSITION OF TIMOTHY J. 09:03:25  
SULLIVAN, Ph.D., produced as a witness on behalf of 09:03:25  
the Plaintiffs in the above styled and numbered  
cause, taken on the 7th day of April, 2009, in the  
City of Tulsa, County of Tulsa, State of Oklahoma,  
before me, Karla E. Barrow, a Certified Shorthand 09:03:25  
Reporter, duly certified under and by virtue of the 09:03:25  
laws of the State of Oklahoma.

09:03:25  
09:03:25

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1 things hanging off the sides and there are many  
2 different kinds. Some of them are carcinogens, some  
3 of them are not.

4 Q These polynuclear aromatic hydrocarbons, where  
5 were they produced, in what industry? 09:21:18

6 A They are produced in combustion activities of  
7 all sorts. What I was studying was the production  
8 and fate of those compounds in association with  
9 slash burning, which is a major component, or was,  
10 it's not so much any more, a major component of 09:21:26  
11 logging operations, after the trees are cut and  
12 removed, then the slash, the small branches, and  
13 later would be burned and that was a way of clearing  
14 the site and causing the replanted trees to grow  
15 better and faster. So it was a common practice to 09:22:05  
16 burn, not all logged areas, but many logged areas,  
17 and there was concern about the production of those  
18 compounds, particularly the ones that were  
19 carcinogenics, and whether or not there was movement  
20 of those into the estuaries, because my major 09:22:13  
21 professor had been studying cancer like growths on  
22 bivalves in the estuaries and finding that there was  
23 a relatively high incidence of that, and one of the  
24 possible causes could have been the production of  
25 these carcinogenic compounds with slash burning, and 09:22:22

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1 for that would have been a wildlife source because  
2 there was no cattle source applied to those plots.  
3 So that would have been the most likely explanation,  
4 in my view.

5 Q Would it necessarily be a fecal particle from 11:04:09  
6 a wildlife source?

7 A I guess it would be pretty tough to say with  
8 certainty. I think it would be easier to conclude  
9 that it would be most likely a wildlife source, and  
10 fecal particle would be one explanation for that. 11:04:19

11 Q Were there any other potential explanations?

12 A I guess it would be possible that there was  
13 fecal material deposited by wildlife in close  
14 proximity to the sampling location and that a  
15 particle was not actually mobilized, but the 11:04:29  
16 bacteria were mobilized from the fecal particles.

17 That would be a possibility. Also, the samples that  
18 I measured of actual bacteria concentration in the  
19 dairy cow manure itself would suggest to me that the  
20 very small components of fecal material could 11:05:09

21 contain rather high numbers of fecal coliform  
22 bacteria in them. And because the manure is in a  
23 thick liquid form, then there would be the  
24 possibility of that manure being dispersed in rather  
25 small components in the water, that could 11:05:22

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1 potentially contain rather high numbers of bacteria.  
2 So that was deduction based on looking at the data  
3 that I collected. But in terms of actually  
4 documenting fecal particles would be more difficult.

5 Q What kind of information do geometric mean 11:06:01  
6 concentrations of fecal indicator bacteria provide  
7 regarding acute exposures to bacteria in surface  
8 waters?

9 MR. BOND: Object to the form.

10 A That was a rather long question, and I'm 11:06:20  
11 really not sure I captured the full thing. Can we  
12 try it again?

13 Q (By Ms. Burch) Absolutely. Do -- in  
14 analyzing geometric mean concentrations of fecal  
15 indicator bacteria levels in surface waters, are you 11:06:29  
16 able to determine whether there are any acute  
17 exposures to extremely high levels of bacteria?

18 A I don't think you're able to determine acute  
19 exposures of anything. I mean, what you're  
20 determining is the central tendency in the data that 11:07:10  
21 are collected as reflected in the geomean  
22 calculation, so it gives you an idea of -- it's --  
23 it's a type of average, it's not an average, it's a  
24 type of average. It doesn't allow the occasional  
25 very high value to have undue influence on 11:07:20

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1 calculation of the average. The reason for that is  
2 what I explained before, that you can get very high  
3 values for various reasons. So that would be my  
4 answer.

5 Q Can you explain how a geometric mean is 11:07:28  
6 calculated for a fecal indicator bacteria standard?

7 A Well, it doesn't matter if it's a standard. I  
8 mean, a geometric mean or a geomean is a calculation  
9 where you -- well, one way to do it is to log  
10 transform each of your concentrations, take the 11:08:07  
11 average and then antilog it. There's a method that  
12 uses the nth root they don't fully understand, but  
13 mathematically it's the same, it gets you the same  
14 number. So that's -- I think if you use a computer  
15 program, it's the use of the nth root method, but it 11:08:16  
16 gives you the same number.

17 Q Are there -- when you're evaluating whether  
18 bacteria -- fecal indicator bacteria levels in a  
19 stream meet or exceed water quality standards, how  
20 do you calculate the geometric mean? 11:08:26

21 A How do I calculate the geometric mean?

22 Q Yes.

23 A I have one of my data analysts calculate the  
24 geometric mean by using either the nth root equation  
25 or the log transformation equation, and it's my 11:09:03

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1 understanding, as I said before, that the software  
2 is typically using the nth root calculation. I  
3 don't know that that's always the case, but  
4 regardless, it gets you the same -- the same  
5 mathematical result.

11:09:10

6 Q How many data analysts do you have employed  
7 that would do this work for you?

8 A Today, I have one, probably, who -- yeah, one  
9 who would do those calculations. I had two. One of  
10 my data analysts was rather recently involved in a  
11 divorce and had to move to a different location to  
12 be with the kids, so he left my employment about a  
13 month ago. So throughout the course of the analyses  
14 for this project, it would have been the two, the  
15 two of them.

11:09:21

11:10:01

16 Q And who are they?

17 A Kai Snyder is the gentleman who has left my  
18 employment, and Todd McDonald is the one who's still  
19 there. So in terms of doing those kinds of  
20 analyses, they would be the two people.

11:10:07

21 Q What is the background of Kai Snyder?

22 A Kai has a master's degree in forest ecology,  
23 and he has a very large amount of experience in data  
24 analysis that would include geographic information  
25 systems and complex databases of environmental

11:10:20

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1 terms of the initial -- the initial writing, I would  
2 say that I wrote parts of that, and two other  
3 scientists wrote other parts of that.

4 Q Did you work with a limnologist on the  
5 drafting of that section of the report?

02:15:24

6 A Well, I mean, a lot of the people that I work  
7 with, including myself, we're more multidisciplinary  
8 environmental scientists rather than pigeonholed as  
9 a limnologist. I don't know that there's anybody in  
10 the group that we necessarily would say is  
11 specifically a limnologist, but a large number of  
12 the authors, including myself, have done a lot of  
13 limnological research.

02:16:03

14 Q When you were evaluating the effects of  
15 nitrogen on the limnology of this lake, did you  
16 employ the Carlson Trophic State Index for your  
17 analysis?

02:16:18

18 A I wasn't looking at one lake. I was providing  
19 an assessment of the issue throughout the United  
20 States, and to what extent our lakes are sensitive  
21 to eutrophication from nitrogen input and where are  
22 such lakes located. Those were the issues that we  
23 were focusing on.

02:16:28

24 Q And just so I understand, which lakes across  
25 the country are sensitive to nitrogen impacts from

02:17:06

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1 might be real smart or really dumb questions. Are  
2 you a medical doctor?

3 A No.

4 Q Are you an epidemiologist?

5 A No. 03:00:08

6 Q Are you a toxicologist?

7 A I have some experience in toxicology, but I  
8 would say no.

9 Q A limnologist?

10 A I classify myself as an environmental 03:00:13  
11 scientist, but I would say that the limnology is an  
12 important part of what I do.

13 Q Are you a soil scientist?

14 A I would say that it's the same answer,  
15 although I do more work in limnology than I do in 03:00:22  
16 soils.

17 Q Are you a hydrologist?

18 A It would be the same answer. I wouldn't  
19 classify myself as a hydrologist, but I have a lot  
20 of experience working with hydrology. 03:01:01

21 Q A hydrogeologist?

22 A I would say no.

23 Q Do you know what a fluvial geomorphologist is?

24 A Roughly I know what it is, and I'm not it.

25 Q Can you tell me what one is? 03:01:12

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IN THE UNITED STATES DISTRICT COURT FOR THE  
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W. A. DREW EDMONDSON, in his )	
capacity as ATTORNEY GENERAL )	
OF THE STATE OF OKLAHOMA and )	08:43:24
OKLAHOMA SECRETARY OF THE )	08:43:24
ENVIRONMENT C. MILES TOLBERT, )	
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cause, taken on the 8th day of April, 2009, in the	
City of Tulsa, County of Tulsa, State of Oklahoma,	08:43:24
before me, Karla E. Barrow, a Certified Shorthand	08:43:24
Reporter, duly certified under and by virtue of the	
laws of the State of Oklahoma.	

08:43:24  
08:43:24

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1 A I didn't do any analyses where I was trying to  
2 compare any particular site anywhere, one site, one  
3 sample, with patterns in Oklahoma. I don't believe  
4 so.

5 Q Did you do any analysis to compare single 10:29:18  
6 sample values for bacteria throughout the Illinois  
7 River watershed to single sample values in other  
8 parts of Oklahoma?

9 A I'm sorry, I don't understand the question.

10 Q Did you do any analysis comparing single 10:29:29  
11 sample bacteria concentrations in the Illinois River  
12 watershed --

13 A Uh-huh.

14 Q -- to single sample bacteria concentrations in  
15 the rest of the state of Oklahoma? 10:30:05

16 A No.

17 Q Did you do any analysis of the influences on  
18 water quality in the Illinois River watershed?

19 MR. BOND: Object to the form.

20 A Well, I think a large part of my report 10:30:19  
21 discusses various aspects of the influences of water  
22 quality. So I think the majority of my report, a  
23 lot of it, at least, is focused on influences of  
24 water quality.

25 Q And how did you attempt to identify sources of 10:30:27

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1 either phosphorus, total phosphorus or fecal  
2 indicator bacteria?

3 A Did I attempt to identify sources. I  
4 evaluated the available data and looked at spatial  
5 patterns in those data relative to areas that could 10:31:07  
6 contain a variety of sources, potential sources, and  
7 from that found that the higher concentrations  
8 tended to be associated with urban areas and  
9 wastewater treatment plant outflow locations. I did  
10 other spatial analyses -- I'm not sure if there's 10:31:22  
11 any other analyses that would get directly at your  
12 question. If you want to give me the question one  
13 more time, I can see if there's something else I can  
14 think of.

15 Q Did you do any other work to identify sources 10:32:01  
16 of total phosphorus or fecal indicator bacteria in  
17 the Illinois River watershed?

18 A Well, I summarized some of the data presented  
19 by Dr. Ron Jarman that would provide specific source  
20 information from wastewater treatment plants. In 10:32:12  
21 most cases, the sources are mixed together. There  
22 were not too many places where there were data that  
23 were particularly helpful to focus on a single  
24 source. I did that with respect to waste water  
25 treatment plants where the plaintiffs' consultants 10:32:25

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1 A Uh-huh.

2 Q To a stream in a rainfall event or even to yet  
3 another location?

4 MR. BOND: Object to the form.

5 A Well, that's going to depend, because if you 11:27:13  
6 start at point A and there is overland flow and it  
7 moves to point B, and then you have another storm  
8 come along, will it move from point B to the stream,  
9 which we'll call point C, and that's going to depend  
10 on a whole bunch of things. We talked about a lot 11:27:20  
11 of this yesterday with respect to the things that  
12 are associated with overland flow. So if the  
13 topography and the landscape factors and the cover  
14 and all the other things that mattered that we've  
15 talked about before, if those are different between 11:27:26  
16 B and C such that overland flow would not be  
17 contributed by that storm, then no, it wouldn't.  
18 But if the conditions were such that overland flow  
19 would be -- would allow movement from B to C, then  
20 perhaps it could. I have no -- I really have no way 11:28:06  
21 to know. It's a site specific kind of an issue.  
22 You can't make general conclusions about whether or  
23 not that would happen.

24 Q Are there areas within the Illinois River  
25 watershed which have application of phosphorus to 11:28:16

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1 the soil which never generate runoff of phosphorus?

2 A I can't tell you that. I can't answer that.

3 What I can say is that phosphorus in poultry litter,

4 according to the rules that are in effect, is not

5 placed in areas that would generate -- or be 11:29:02

6 expected to generate an appreciable amount of

7 overland flow. That's the reason that those areas

8 are selected and the farmers are instructed to not

9 apply phosphorus to those areas, and that's the

10 reason why they will use things like phosphorus 11:29:11

11 indices to try to decide the relative risk of

12 phosphorus transport to avoid -- to avoid those

13 areas.

14 Q And my question was more general than poultry

15 waste, and the question was, if phosphorus in the 11:29:18

16 form of animal waste or fertilizer or biosolids,

17 whatever the source, is applied to the surface of

18 the lands in the Illinois River watershed --

19 A Uh-huh.

20 Q -- are there some locations within the 11:29:26

21 Illinois River watershed where that phosphorus will

22 be -- remain forever and not be transported via

23 runoff or infiltration?

24 MR. BOND: Object to the form.

25 A I'm not sure. We've discussed this before, 11:30:04

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1 answered.

2 A There are places in the Illinois River  
3 watershed where one would not expect that there  
4 would be appreciable movement of phosphorus from  
5 that area to another area or, in particular, to a 11:31:22  
6 nearby stream. That's probably the majority of the  
7 land area, but I've not conducted analyses to try to  
8 determine that it's the majority of the land area,  
9 but that would be my general sense, that there are  
10 certain areas that have conditions such that one 11:32:03  
11 would expect that the opportunity for phosphorus to  
12 move is probably there, at least some portions of  
13 it, and that there would be an increased risk of  
14 phosphorus movement under storm conditions  
15 typically. And so there are conditions that are 11:32:11  
16 reasonably well understood and defined where you  
17 expect to find those areas, and then the other areas  
18 you expect to not find that situation.

19 Q (By Ms. Burch) And, you know, I just want to  
20 make sure I understand. Is the answer yes, there 11:32:21  
21 are areas where within the Illinois River watershed  
22 that phosphorus will not be released in runoff?

23 MR. BOND: Object.

24 A I've not tried to determine if there are areas  
25 like that, and if so, where they are. What I can 11:32:29

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1 of that question.

2 A Can I have that question one more time,  
3 please?

4 Q (By Ms. Burch) Yeah. Maybe I'll ask them  
5 separately and that will help. Are there any areas 02:47:17  
6 in the Illinois River watershed, surface waters,  
7 where phosphorus standards are exceeded and there  
8 are no impacts of wastewater treatment plants?

9 A I didn't conduct analyses to determine areas  
10 where phosphorus standards were exceeded because 02:47:27  
11 that requires the 30 day geomeans, so that's not  
12 something that I evaluated. I would not have had  
13 the data to make such an evaluation in very many  
14 places in the watershed, I don't think.

15 Q Okay. Let's look back at your -- do you know 02:48:06  
16 whether there are any areas within the Illinois  
17 River watershed that have high phosphorus  
18 concentrations that are not influenced by wastewater  
19 treatment plants?

20 MR. BOND: Object to the form. 02:48:19

21 A What do you mean by high concentrations in  
22 this question?

23 Q (By Ms. Burch) I guess for the purpose of  
24 this question, let's use greater than .037 as a  
25 geometric mean. 02:48:29

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1 MR. BOND: Object to the form, asked and  
2 answered.

3 A So the samples that are greater than .037  
4 milligrams per liter of total P. I have two display  
5 items, Figure 5.5 and 5.6, that address that. 02:49:07  
6 Figure 5.5, that's a map where the height of the bar  
7 is proportional to the concentration of total  
8 phosphorus, and what it shows is that the highest  
9 concentrations of total phosphorus are, under base  
10 flow conditions as identified by Dr. Olsen as being 02:49:17  
11 base flow, from his database, it shows that the  
12 highest concentrations are consistently below the  
13 wastewater treatment plants in urban areas. But  
14 there are also some sites that are not downstream  
15 from wastewater treatment plants in urban areas that 02:49:25  
16 are also above the .037, but they're not nearly as  
17 high as the sites that are below -- many of the  
18 sites that are below urban land and wastewater  
19 treatment plants. And then the 5.6 is the same  
20 analysis except it's not restricted to just samples 02:50:03  
21 that Dr. Olsen had classified as base flow. And on  
22 that plot, I see exactly the same pattern is that  
23 the highest values of total phosphorus concentration  
24 very consistently are both high and low flow and all  
25 flow conditions very consistently directly below the 02:50:13

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1 urban areas and the wastewater treatment facility  
2 locations, but again, there are locations in areas  
3 that are not lower than wastewater treatment plant  
4 locations that are also above the .037, but they're  
5 not nearly as high as the ones downstream from urban 02:50:21  
6 and wastewater treatment facilities.

7 Q Now, these are geometric mean calculations; is  
8 that correct?

9 A That's correct.

10 Q Are they based on five samples in a 30 day 02:50:26  
11 period? I think you might have answered that,  
12 but --

13 A They're not.

14 Q Why did you choose to focus this analysis just  
15 on what you've called Roger Olsen's total P data? 02:51:02

16 A Well, this is a very rich database for the  
17 IRW, lots and lots of locations. This gives me the  
18 opportunity to look at these spatial patterns, and  
19 these were data collected by the plaintiffs, so I'm  
20 assuming the plaintiffs are not going to object to 02:51:15  
21 the use of their own data. So there are many  
22 reasons why I chose to use the data from Dr. Olsen.  
23 It's the State's data for the case, and there's  
24 ample data with which to evaluate spatial questions.

25 Q And I appreciate that. Is there a reason why 02:51:24